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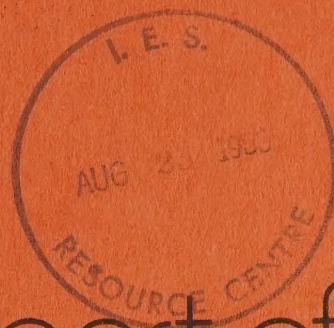


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report of the sydney respiratory health survey

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REPORT OF THE

SYDNEY RESPIRATORY HEALTH SURVEY

BY

ENVIRONMENTAL HEALTH DIRECTORATE
HEALTH PROTECTION BRANCH

IN COLLABORATION WITH

DEPARTMENT OF PUBLIC HEALTH

NOVA SCOTIA

PUBLISHED BY AUTHORITY OF THE
MINISTER OF NATIONAL HEALTH AND
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MARCH 1977



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ABSTRACT

A study, undertaken in January-March 1976, demonstrated a small but statistically significant connection between respiratory function in school children living at Sydney, Nova Scotia, and the degree of air pollution in the locality where they lived and went to school. There was no evidence that this resulted in disease as judged by ear, nose and throat examinations made concurrently.

No such differences were observed in adults in the community, probably because such factors as smoking and occupational exposure may have masked any effects. Respiratory function measurements in adults were close to the predicted values for a normal population.

RÉSUMÉ

Une étude effectuée de janvier à mars 1976 a mis en évidence une relation mineure, mais statistiquement significative, entre la fonction respiratoire chez les écoliers de Sydney (Nouvelle-Ecosse) et le degré de pollution de l'air de l'endroit où ils vivent et vont à l'école. Rien n'indiquait, selon les résultats d'examens oto-rhino-laryngologiques effectués pendant cette période, que cela était cause de maladie.

On n'a pu observer de différences semblables chez la population adulte de l'endroit; il est logique de supposer que des facteurs tels que l'habitude du tabac et l'exposition professionnelle les masqueraient. Les mesures de la fonction respiratoire chez les adultes se situaient près des valeurs prévues pour une population normale.

ACKNOWLEDGMENTS

This study was undertaken by a survey team from the Health Effects Division, Bureau of Chemical Hazards, Environmental Health Directorate, Health Protection Branch. Dr. M. Grimard was instrumental in planning the survey, co-ordinating its execution and in preparing the report. The Environmental Health Directorate mobile laboratory team consisted of Dr. C.J. Eagan assisted by J. Kelly, L. Mathieu and W. Gorman. Dr. A. Pointer, Laboratory Centre for Disease Control, was responsible for conducting ear, nose and throat examinations. Dr. R. McCullough, Mr. R. Tate, Mr. G. Symonds and Miss D. Hobbs of the Statistics and Data Processing Division, Environmental Health Directorate, provided invaluable help in processing the data and analyzing the results.

Acknowledgments are extended to the following for their support, assistance and co-operation:

The citizens of Sydney and New Waterford who participated in the survey.

The Cape Breton health units, particularly Drs. N.F. Macneil and L.D. MacCormick and their staff.

The Boards of Health and Education and school principals in Sydney and New Waterford.

The Federal and Provincial Departments of the Environment which provided invaluable data on air pollution levels in recent years which formed the basis for designing this survey. Dr. R. Shaw, Environmental Protection Service, arranged financial support to maintain the survey team in Sydney.

Particular thanks are due to Mr. C.E. Tupper, Nova Scotia Department of Health, who co-ordinated the many federal and provincial agencies in the region who contributed and whose efforts in this respect greatly facilitated the work of the survey team.

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I - THE STUDY BACKGROUND

Several studies have dealt with the air pollution situation in Sydney, Nova Scotia. One of the first reports, by Kilotat and Wilson in 1970 (1) showed air pollution had greatly increased during the period from 1959 to 1970. Several air pollutant sources were apparent: the steel mill of the Sydney Steel Corporation (SYSCO), the coke ovens of the Cape Breton Development Corporation (DEVCO), the thermal power plant, domestic heating and automobile traffic.

In July 1972, a more elaborate monitoring programme (project S-72-1 of the Department of Fisheries and the Environment) was decided upon by the authorities concerned. Additional sampling stations were set up with new and improved equipment. The geographical location of these sampling stations was established on the basis of air pollution measurements made from 1965 to 1970 and local weather conditions. This network has clearly established that sulphur dioxide (SO_2) and particulate matter are dominant Sydney air pollutants; the Federal Department of Fisheries and the Environment has continued to make extensive measurements of these pollutants since 1972.

From the reported measurements (2), it has been observed that, in certain Sydney locations, the air pollution levels often exceed the maximum acceptable values proposed by the Department of Fisheries and the Environment. It should be noted that the National Air Quality Objectives define three levels of air pollution: the maximum desirable level, the maximum acceptable level and the maximum tolerable level (3). The maximum acceptable level is intended to provide adequate protection against effects on soil, water, vegetation, material, animals, visibility, personal comfort and well-being. This level presently represents the realistic objective across Canada. When this level is exceeded, control action by a regulatory agency is indicated (Clean Air Act Report 1974-75, page 71) (3).

TABLE 1 shows the maximum acceptable and maximum desirable levels for sulphur dioxide and suspended particulate matter.

Because of the high air pollution levels, the possibility that air pollution levels in Sydney may have an adverse influence on the health of the citizenry was considered and the Department of National Health and Welfare had been contacted with a view to conducting epidemiological studies in Sydney to establish, if at all possible, the presence or the absence of such adverse effects. Moreover, the citizens, through their representatives and media, had asked for such a study. The present survey was carried out by the Health Effects Division of the Environmental Health Directorate, Health Protection Branch, Department of National Health and Welfare, with the assistance of the Nova Scotia Department of Public Health and the Department of Fisheries and the Environment.

TABLE 1

CANADIAN AMBIENT AIR QUALITY OBJECTIVES FOR SULPHUR DIOXIDE
AND SUSPENDED PARTICULATES

AIR CONTAMINANT	MAXIMUM ACCEPTABLE LEVEL	MAXIMUM DESIRABLE LEVEL
Sulphur dioxide	60 ug/m ³ Annual arithmetic mean	30 ug/m ³ Annual arithmetic mean
	300 ug/m ³ Average concentration over a 24 h period	150 ug/m ³ Average concentration over a 24 h period
	900 ug/m ³ Average concentration over 1 h period	450 ug/m ³ Average concentration over a 1 h period
Suspended particulate matter	70 ug/m ³ Annual geometric mean	60 ug/m ³ Annual geometric mean
	120 ug/m ³ Average concentration over a 24 h period	

II - SELECTION OF STUDY POPULATIONS

The effects of air pollution on human health depend both on the nature of the pollutants and on the degree of exposure. Exposure itself is a function of concentration of pollutants and duration of exposure. For given identical exposures, one cannot be sure that every individual will respond identically since people differ in their ability to respond to stress. This is why it is essential to observe a large number of individuals before attempting to draw conclusions on the effect, good or bad, of environmental factors. As well, it is necessary that the individuals in the study population be as similar as possible in all respects apart from the pollution exposure factor. Finally, it is necessary to select carefully the parameters to be studied as indicators of health.

At Sydney, we were dealing with a classical type of air pollution: SO₂ and particulate matter. Therefore, we focussed our attention on the respiratory health of the study subjects, studies elsewhere having previously established the health effects of this common type of air pollution (4).

Air pollution is only one of the many factors that influences respiratory health. For example, in addition to the well-known fact that smokers are more susceptible to lung cancer than non-smokers, they are also more likely to suffer from emphysema and chronic bronchitis. In fact, it has been estimated that, from this standpoint, cigarette smoking is a much more important factor than air pollution (5). Also, occupational exposure to harmful particulate and to gaseous matter in sufficient quantities may affect respiratory health.

Because of the importance of smoking and occupational exposure as factors affecting respiratory health, school children are often used in studies in which the effects of airborne pollutants are of interest (6, 7, 8, 11, 12, 13). Children present many advantages: they do not usually smoke, their lifestyle, when they are not at home or on vacation is, for all practical purposes, the same and, from the standpoint of logistics, school children form a semi-captive group which is readily available for survey purposes. For these reasons, it was proposed initially to carry out the survey in school children using their estimated degree of exposure to air pollution as the independent variable. Discussions with Cape Breton public health authorities established the feasibility of examining a population of about 600 children in the 4th, 5th, 6th and 7th grades. Eleven schools were selected for sampling purposes from lists supplied by the Sydney Board of Education. These were Don Bosco, Holy Redeemer (boys), Holy Redeemer (girls), Whitney, Villanova, Jamieson, Eastmount, St. Michael, Scotchtown Memorial, St. Anthony Daniel, Argyle. Figure 1 shows the location of the schools with the exceptions of St. Michael and Scotchtown Memorial which are

located in New Waterford, Nova Scotia, a municipality approximately 15 kilometers north east of Sydney (suggested by Cape Breton health authorities as a suitable control population group).

The Cape Breton local health authorities expressed strong wishes that the survey should be extended to include adult subjects, even though the probability of finding significant differences related to air pollution was slight in view of the masking effect of smoking and occupational factors. Accordingly, it was decided to examine also parents of the children in the sample population, thus ensuring a degree of stratification in the adult sampling.

DON BOSCO

WHITNEY

HOLY REDEEMER BOYS

HOLY REDEEMER GIRLS

VILLANOVA

ARGYLE

ST. ANTHONY DANIEL

JAMIE SON

-5-

EASTMOUNT

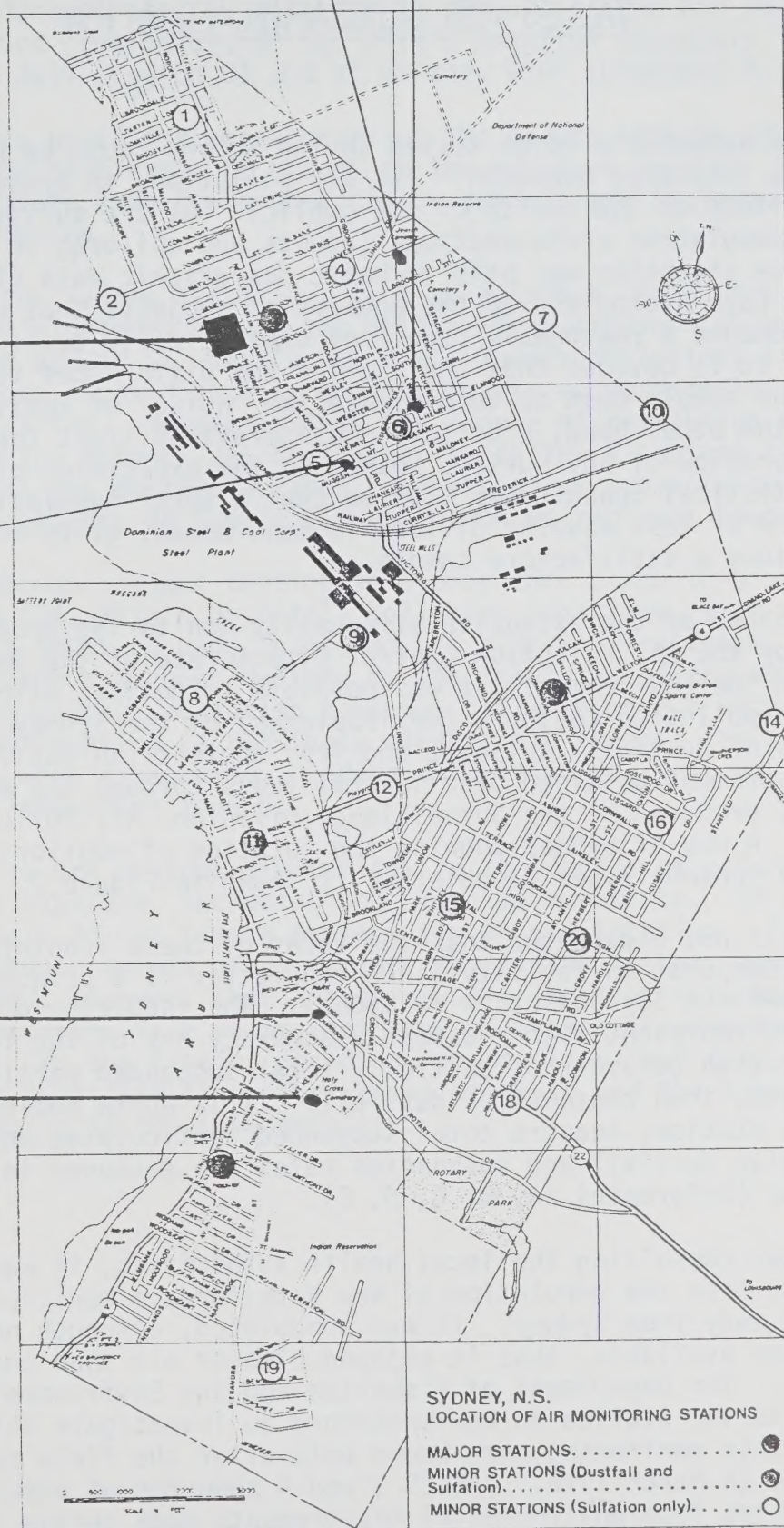


Figure 1 Sydney School Location

III - SAMPLING DESIGN, AIR POLLUTION VALUES AND GEOGRAPHIC LOCATION

The hypothesis to be tested in the survey could be put very simply in the following question: "Is air pollution, in Sydney, having an adverse effect on the health of the public?" As the survey was to examine two population cross-sections (adults and children in certain age brackets), due attention was paid to basic demographic data (TABLE 2) for this part of Cape Breton and to the numbers of subjects that would be required to ensure a reasonable chance of statistically testing the above hypothesis. It is obvious that the smaller the differences to be measured, the larger the sample must be to minimize the "noise" of individual variations. On the other hand, practical considerations limit the possible extent and duration of any survey. Based on the experience of similar studies, statistical consultants advised that a total population of one thousand, more or less equally divided in men, women, girls and boys, would constitute a satisfactory sample.

Because of the extensive air quality monitoring programme carried out by the Air Pollution Control Directorate of the Department of Fisheries and the Environment, it was possible to define, with reasonable accuracy, the pollution contours (or isopleths) of the Sydney territory. Isopleth maps of dustfall, sulphate and iron content (in dustfall) values based on measurement obtained over several years through the monitoring stations were produced by the Surveillance Division, Air Pollution Control Directorate. A map of Sydney showing the location of monitoring stations and pollution contour lines (isopleths) is shown in Figure 2.

It is not unexpected that the focus of these isopleths is the Sydney Steel Corporation facility since the latter is a principal source of particulates and SO₂ pollution in Sydney. The isopleths drawn in Figure 2 could represent with reasonable accuracy any of the following measured pollution parameters; dustfall, total suspended particulates, sulphation rate, iron contents of dustfall. It is worth noting that, in Sydney, three stations measure total suspended particulates and other parameters while dustfall and sulphation rates are measured in the other nine locations (References 2A, B, C, D, E).

After consulting the local health authorities, it was decided to investigate also the population of New Waterford, a municipality about 15 kilometers away from Sydney. It was speculated, although no environmental data was available, that it enjoyed cleaner air than any area within Sydney. The Department of Fisheries and the Environment established a monitoring station in New Waterford to investigate this. Results from this monitoring were known only after the field survey had been completed in March 1976. TABLES 3 and 4 show recent unpublished pollution figures from environmental measurements made during 1975 and

1976. These demonstrate the relative importance of the air pollution in New Waterford (region 0), at St. Rita's Hospital (boundary 1 and 2), at the County Jail (region 3) and at Whitney Pier (boundary 5 and 6).

It is usual for researchers on the health effects of air pollution to compare high exposure groups to low exposure groups. Sometimes also, intermediate exposure groups can be defined and included in the experimental design.

In the Sydney situation, such an approach could have been taken using subjects clustered around the Whitney Pier station (highest air pollution) and around St. Rita's Hospital (lowest pollution) and by defining a group exposed to intermediate levels as measured at the old County Jail station. However, since the degree of resolution afforded by the monitoring network was sufficient to define a logical continuum of exposure, it was decided a finer subdivision of subjects could take place using isopleths of Sydney air pollution as regional boundaries.

Although subject testing in Sydney took place in high (Whitney Pier) and low (St. Rita's Hospital) pollution locations, each subject was allotted a location code, based on his place of residence, falling within one of the six zones defined by the isopleths of the map in Figure 2. The highest pollution zone was called number 6 with numbers 5, 4, 3, 2, 1 representing increasingly cleaner air zones. The New Waterford subjects were designated, pending definition of their environmental exposure, as inhabiting zone 0.

There are obvious limitations to the degree of accuracy of any definition of exposure, including one based on residence. Of course, most individuals do not remain permanently in one location. Furthermore, indoor and outdoor levels of pollutants may differ at the same location. We have assumed, however, that the geographic location determined by the address of residence is a valid indicator of a specific degree of exposure to pollution. In the case of children, we consider that this assumption is especially justified since the school attended and the place of residence are usually in the same locality.

TABLE 2

DEMOGRAPHIC DATA (1971 CANADA CENSUS)

	<u>SYDNEY, N.S.</u>	<u>NEW WATERFORD, N.S.</u>
Population	33 230	9 579
male	16 222	4 867
female	17 008	4 717
Households	7 257	2 023
Persons/household	4	4.3
Children/family	2	2.3
Cape Breton: number of bedrooms/dwelling	2.9	
number of persons/room	0.73	

(Source Statistics Canada)

TABLE 3
30 DAYS SULFATE LEVELS IN FOUR LOCATIONS

Location Time	New Waterford	County Jail	Whitney Pier	St. Rita's
August/75	9.2	10.8	11	1.8
September/75	12.4	4.3	19.3	3.5
October/75	--	18.1	24.1	7.7
November/75	--	25.9	29.4	15.5
December/75	34.5	15.5	38.0	0.9
January/76	24.9	29.5	24.0	18.1
February/76	16.5	18.0	20.8	9.4
March/76	22.8	8.3	19.6	--
April/76	19.8	10.9	15.8	6.0
May/76	-----NO DATA-----			
June/76	13.0	4.6	12.5	7.1
Means	19.1	15.7	23.5	7.7

Units are in mg SO₃/100 cm² for a 30 day period.

(Source - Ken Miller - Air Pollution Control Directorate - Environment Canada)

TABLE 4
TOTAL SUSPENDED PARTICULATES IN THREE LOCATIONS

Time \ Location			
	Whitney Pier	St. Rita	New Waterford
July/75	73	45	64
	98	40	112
	292		86
	102		
	141		
	76		
August/75	79	30	106
	61	59	109
	169	47	57
	104	33	116
	207	40	112
	51	49	
	57		
	148		
September/75	47	23	84
	112	42	102
	187	39	141
	275	48	56
	157	20	40
	140		
	55		
Means	125.3	39.6	83.4

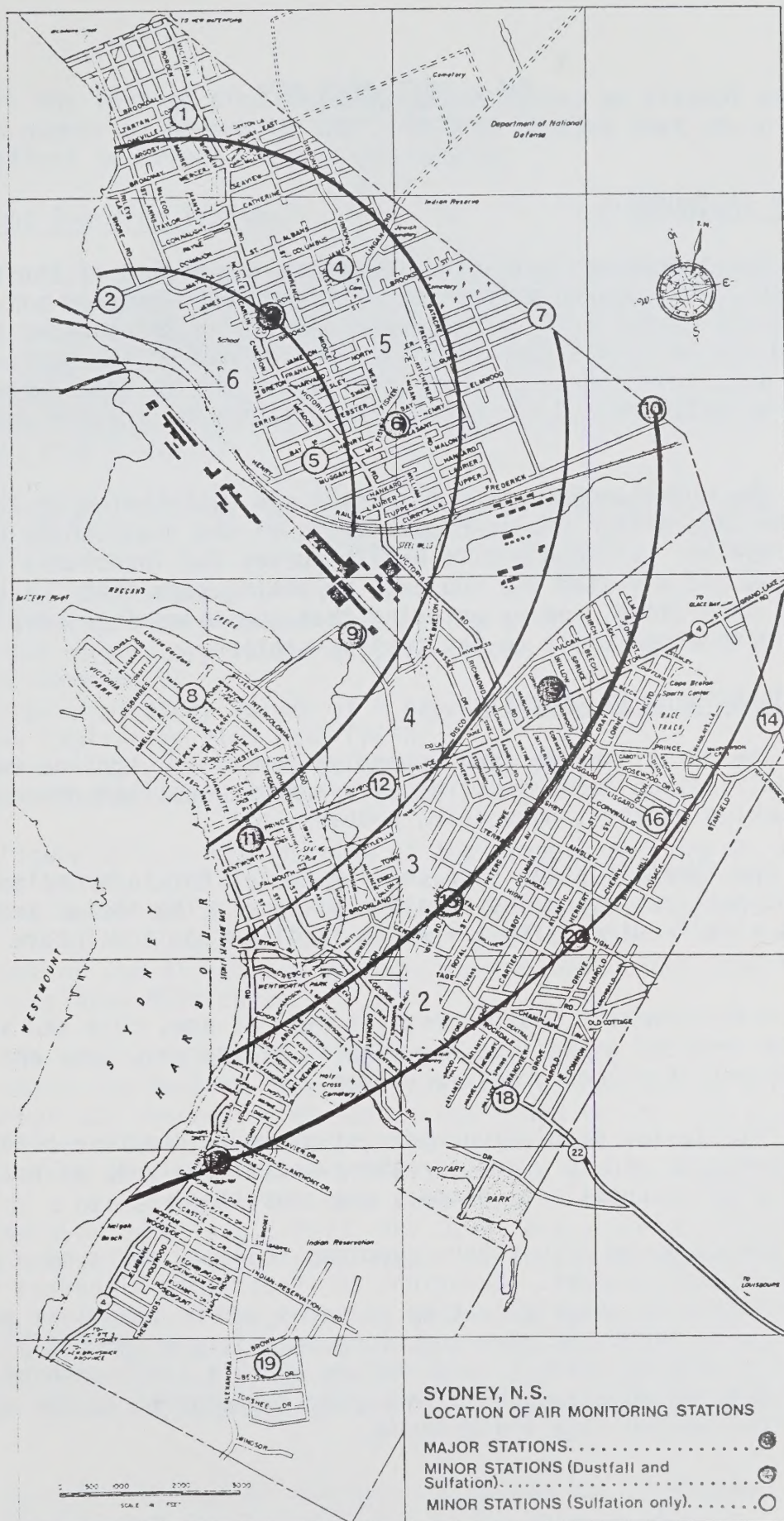


Figure 2 - Sydney Pollution Regions and Isopleths

IV - METHODOLOGY

1. SURVEY INSTRUMENTS

Two approaches were used to assess the health of the population under study; first was an extensive questionnaire patterned after Bouhuys' adaptation (9) of the British MRC Questionnaire on Respiratory Symptoms, the second one being a maximum expiratory flow and volume test. In addition, ear, nose and throat examinations of the children were performed by a physician and the blood pressure of adults was routinely measured.

The questionnaire (see Appendix) was distributed to the subjects through the Cape Breton Public Health Units of the Nova Scotia Department of Public Health. Trained public health nurses and inspectors visited the families and assisted the subjects by making sure that the questions were fully understood, and by ensuring that questionnaires were properly completed before the visit to the testing station.

1. (a) Questionnaire contents

The questionnaire (see Appendix) comprised sections on: basic identification data, respiratory symptoms, past and present illnesses, smoking history, household, hobbies, etc.

The identification data section called for information on current and past residence and duration of same. The social insurance number was also required with a view to facilitating any future follow-up studies.

Anthropometric measurements as well as age, race and sex information were recorded as well as the results of the ear, nose and throat examination and the blood pressure values.

Because the population under study would comprise both children and adult subjects and to allow for the eventual analysis of occupational factors, a short occupational history was requested.

Questions on respiratory symptoms followed the proven pattern of MRC type questionnaires. Questions on respiratory illnesses in the last three years, on hospitalization episodes and on school or work absenteeism were asked, as were questions on allergic tendencies. A comprehensive smoking history is a feature of this questionnaire and the programme performs an accumulated pack-year computation as the age-cigarette consumption data are entered.

In the last section of the questionnaire, an attempt was made to define a number of household and lifestyle factors that could conceivably reflect or affect fitness and health.

1. (b) Lung Function Testing

To facilitate, expedite and standardize the task of data collection and lung function testing, the Health Effects Division used a mobile laboratory equipped with a mini-computerized testing and recording system developed at the Yale University Lung Research Centre (10). The system comprises an integrated questionnaire entry and respiratory test package which outputs interview and lung function data directly in a computer-compatible format.

The lung function test performed (the MEFV test), allowed the calculation of:

1. Forced vital capacity (FVC)
2. Forced expiratory volume at 1 second (FEV1)
3. Forced expiratory volume at 0.75 second (FEV 0.75) (children only)
4. Forced expiratory volume at 3 second (FEV3) (adults only)
5. Peak expiratory flow rate (PEFR)
6. Maximum expiratory flow at 50% of FVC (MF 50)
7. Maximum expiratory flow at 25% of FVC (MF 25)

Figure 3 is a reproduction of the image appearing on the terminal screen at the termination of the test. The interview data appears in coded form above the MEFV curve. Opposite the curve appears the values FVC, FEV1, PEFR, MF 50 and MF 25. COVAR is not a respiratory parameter but a measure of the difference between the two best blows used to derive the final displayed MEFV curve.

The display also shows the predicted values of FVC, FEV1, PEFR and MF 50 which are derived from the insertion of subject height, age and sex in appropriate regression equations contained in the computer programme. The actual values are expressed in terms of percentage of the predicted values while the ratio of FEV1 to FVC is also displayed and expressed as a percentage. The data appearing on the tube as well as other undisplayed data (e.g., FEV3, FEV 0.75, etc.) are all recorded on a computer-compatible punched paper tape for subsequent processing.

Calibration Procedure - The procedure described by Bouhuys et al (10) was followed. Calibration was checked daily before any examinations were made and again periodically during the day. A correction factor of 1.075 was used to allow the measured values to be expressed under BPTS conditions.

Predicted Values - During the survey, the system was programmed to compute the predicted values according to the data in TABLE 5.

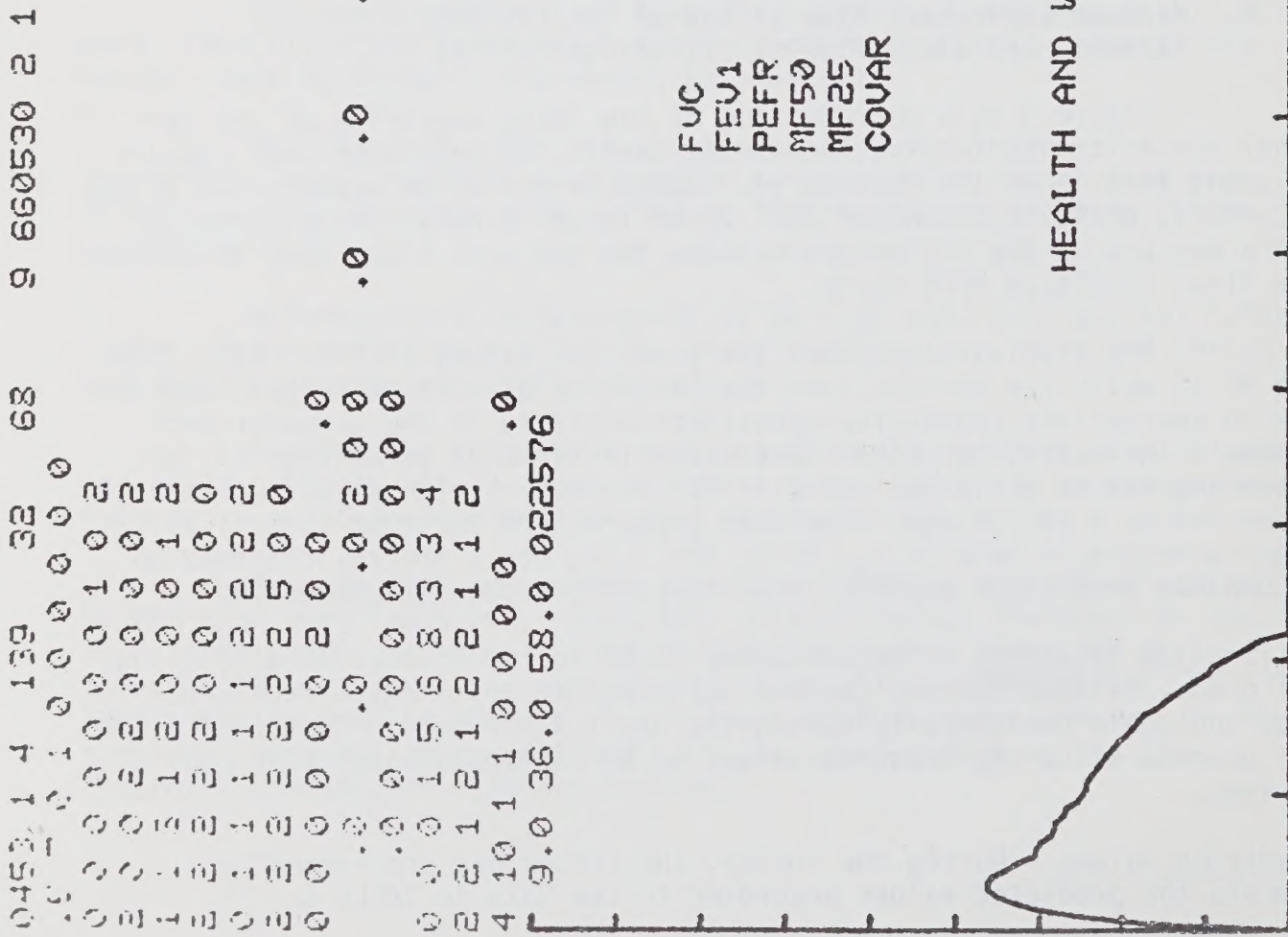


FIGURE 3

TABLE 5

PREDICTION EQUATIONS, COEFFICIENTS AND CONSTANTS

EQUATIONS

$$\text{FVC} = \text{C1} + \text{C2} \times \text{AGE} + \text{C3} \times \text{HEIGHT}$$

$$\text{FEV1} = \text{C4} + \text{C5} \times \text{AGE} + \text{C6} \times \text{HEIGHT}$$

$$\text{PEFR} = \text{C7} \times \text{FVC}$$

$$\text{MF 50} = (\text{C8} + \text{C9} \times \text{AGE}) \times \text{FVC}$$

COEFFICIENTS AND CONSTANTS

	<u>MEN</u>	<u>WOMEN</u>	<u>BOYS</u>	<u>GIRLS</u>
C1	-1.57	-0.7	-5.71	-4.42
C2	-0.03474	-0.02718	0.0	0.0
C3	0.04231	0.03012	0.06	0.049
C4	-0.108	0.169	-4.77	-3.35
C5	-0.03502	-0.02711	0.0	0.0
C6	0.02934	0.02191	0.051	0.041
C7	2.3	2.03	1.72	1.72
C8	1.32	1.32	1.2	1.2
C9	-0.009	-0.009	0.0	0.0

Source: Bouhuys et al - Yale University Lung Research Centre.

Two or three points are worth remembering when looking at the scores that will result from the use of prediction equations. Essentially, the formulas and coefficients have been statistically derived from very large numbers of individual measurements. In the case of Sydney adults, it can be seen in TABLE 8, for instance, that the Sydney FVC, FEV1 are not very different from the predicted values. We concluded that the system prediction equations for adults were acceptable.

The case of children was different. The Yale values proved a poor prediction of pulmonary performance in children. To make any kind of worthwhile contribution to comparing children in each group, prediction equations and specific factors were obtained through regression analysis of the actual data from the Sydney boys and girls. The resulting normal values are shown in TABLE 10.

It should also be mentioned that in dealing with black subjects, the prediction equation results are multiplied by 0.85, i.e., a derating of 15%. The anatomical basis for this is that the trunk body length ratio differs between the black and white races. If this correction was not applied, the predicted values would erroneously show the performance of black subjects as below normal.

2. SURVEY PROCEDURE

The field survey started on January 29, 1976, and was finished on March 19, 1976. A short period of time such as this is advantageous for keeping to a minimum the effects of seasonal variation. Both children and adults were examined concurrently; the children were examined at appointed times scheduled by the Cape Breton Public Health Units. Generally, the adults were processed in late afternoon and evening on weekdays and on Saturdays.

To familiarize the subjects with the survey procedure, a videotape recording depicting the process of questionnaire and test administration was produced for this survey by Audio-Visual Services, Department of National Health and Welfare. The recording was played to various concerned groups involved either as subjects or as project collaborators.

The subjects, adults or children, reported for the examination with their completed questionnaire. At this time, they were weighed to the nearest kilogram and both standing and sitting height were measured (with shoes off) to the nearest 0.5 cm. Blood pressure was measured in adults; for children, an ear, nose and throat examination was conducted.

As the subject presented himself, he would turn in his completed questionnaire. The answers to the questions were then entered by the terminal operator into the computer memory while a trained technician explained the maximum expiratory effort manoeuvre. The data entry phase provided an occasion for verifying that the questionnaire had been properly completed.

A minimum of five blows were required from each subject; of these, the best two are combined by the computer programme (10) and a composite curve calculated and displayed. The system allowed the operator to repeat the test if five trials proved insufficient.

At the termination of the test, a hard copy unit produced a paper copy of the display on the terminal cathode ray tube. This copy was attached to the completed questionnaire while the punched paper tape record containing the complete interview and test data was kept for further processing.

V - RESULTS AND STATISTICAL ANALYSIS

1. RESULTS

After transcribing information from the punched paper tapes onto standard format magnetic tape for data processing purposes, each individual file was checked for incorrect or missing values. Mistakes were traced either through referring to the individual printed questionnaire or to the subject himself. To allow feed-back to the survey participants and eventual follow-up, a separate address file was also created.

TABLE 6 shows that a total of 1,222 persons were surveyed. Of these, 399 school children (197 girls and 202 boys) and 445 adults (239 women and 206 men) for a total of 844 persons were residents of Sydney distributed across the Sydney pollution regions indicated previously (Ref. Figure 2).

TABLE 6

SUBJECTS BY CATEGORY AND REGION

<u>Region</u>	<u>Children</u>		<u>Adults</u>	
	<u>Boys</u>	<u>Girls</u>	<u>Men</u>	<u>Women</u>
1	64	62	82	84
2	13	32	27	30
Sydney 4	30	27	29	33
5	74	56	50	68
6	21	20	18	24
Sydney Total	<u>202</u>	<u>197</u>	<u>206</u>	<u>239</u>
New Waterford	<u>87</u>	<u>90</u>	<u>95</u>	<u>106</u>
Grand Total	<u>289</u>	<u>287</u>	<u>301</u>	<u>345</u>

Total subjects

1 222

The second step in the analysis process has consisted in producing tabulations of the results by regions (0 to 6) for men, women, boys and girls taken as separate groups. As the number of subjects in region 3 was extremely small, it was decided to reassign them to region 4 and 2 on the basis of their proximity to either one of the adjacent regions.

In the case of continuous variables such as height, age and pulmonary function parameters, the mean, standard deviation and standard error were computed for each region. The maximum and minimum values as well as the number of individuals in the regional sub-sample were also obtained.

For discrete variables, two sets of similar tabulations were produced: the first one was for yes-no answers (e.g., "Do you cough in the morning?"), the second one for multiple choice questions (e.g., "Which of the following best describes your occupation"). For these data, the number of different answers was given and expressed as a percentage of the regional sub-sample.

Results on a regional basis are given in TABLES 7, 8, 9, 10 and 11.

A typical tabulation of answers to questionnaire items is shown in TABLE 12. The complete computer printout tabulations are not included in the report in order to keep it compact. However, they are available, upon request, for research purposes.

TABLE 7

ADULTS - Characteristics by regions

Sex and Region Characteristic	MEN						WOMEN					
	0	1	2	4	5	6	0	1	2	4	5	6
No.	95	82	27	29	50	18	106	84	30	33	68	24
Age (years) mean	42.0	40.9	45.7	40.7	46.3	47.3	39.7	38.3	42.9	39.2	42.3	43.5
Std. Dev.	9.30	6.78	8.80	8.43	10.89	9.42	7.34	5.81	7.32	7.23	8.50	8.23
Std. Err.	0.96	0.75	1.73	1.59	1.56	2.28	0.72	0.64	1.36	1.28	1.04	1.72
Height (cm) mean	174.64	175.65	174.41	174.66	174.22	174.39	160.60	160.29	160.67	160.03	161.37	160.96
Std. Dev.	5.64	6.15	5.10	5.78	6.76	5.62	5.39	5.49	5.90	6.33	5.38	6.20
Std. Err.	0.58	0.68	1.00	1.09	0.97	1.36	0.53	0.60	1.10	1.12	0.66	1.29
Mass (wt) (kg) mean	81.38	82.50	84.59	82.72	82.32	82.72	65.50	61.73	65.07	63.97	66.16	68.88
Std. Dev.	13.40	11.76	15.56	14.08	15.65	10.83	13.31	11.46	9.91	14.46	13.53	11.48
Std. Err.	1.38	1.31	3.05	2.66	2.24	2.63	1.30	1.26	1.84	2.56	1.65	2.39
Race - White	95	76	27	26	42	18	105	78	30	31	60	23
- Black		1		3	7		1			2	8	1
- Other		5			1			6				
Length of present residence 0-5 (years)	27	16	6	12	9	2	31	13	7	12	17	4
6-10	13	25	4	4	7	1	16	26	4	5	7	1
10 +	55	41	17	13	34	15	59	45	19	16	44	19

TABLE 8
ADULTS - Pulmonary function results
by regions

Sex and Region Pulmonary Function Results	MEN						WOMEN					
	0	1	2	4	5	6	0	1	2	4	5	6
Forced vital capacity (FVC) - liters	4.18	4.48	4.07	4.32	4.14	4.10	3.09	3.20	3.10	3.12	3.22	3.09
Percent predicted FVC (PPFVC)	96.57	101.82	97.60	100.92	101.38	99.14	101.45	103.94	104.00	103.37	109.73	104.60
Forced expiratory volume (1 second) (FEV ₁) - liters	3.43	3.69	3.36	3.54	3.31	3.27	2.62	2.78	2.59	2.63	2.64	2.48
Percent predicted FEV ₁ (PPFEV ₁)	96.74	102.67	98.94	100.90	99.80	98.11	100.78	105.36	102.36	101.47	105.61	99.47
Forced Expiratory volume (3 seconds) (FEV ₃) - liters	4.12	4.40	4.02	4.26	4.03	4.02	3.06	3.18	3.06	3.08	3.15	3.04
Peak expiratory flow rate (PEFR) liters/second	8.50	10.04	8.89	9.14	8.77	8.79	5.58	6.81	6.04	6.22	5.95	5.77
Percent predicted PEFR	89.18	98.78	95.29	95.45	94.72	94.56	90.16	105.78	97.02	99.91	93.18	92.98
MF 50	4.40	4.93	4.46	4.71	4.44	4.37	3.70	4.16	3.85	3.88	3.68	3.48
MF 25	1.89	1.96	1.69	1.95	1.64	1.69	1.66	1.72	1.53	1.48	1.42	1.19
FEV ₁ /FVC	0.82	0.83	0.83	0.82	0.80	0.80	0.85	0.87	0.83	0.84	0.82	0.80

TABLE 9

CHILDREN - Characteristics by regions

Sex and Region Characteristic	GIRLS							BOYS					
	0	1	2	4	5	6	0	1	2	4	5	6	
No.	90	62	32	27	56	20	87	64	13	30	74	21	
Age (years) mean	10.7	10.3	10.8	11.5	11.2	11.2	11.09	10.61	11.00	11.67	11.01	11.24	
Std. Dev.	1.27	0.91	0.92	1.09	1.41	1.49	1.37	0.99	0.71	1.45	1.50	1.45	
Std. Err.	0.13	0.12	0.17	0.21	0.19	0.30	0.15	0.12	0.20	0.27	0.18	0.32	
Height (cm) mean	144.14	142.19	146.94	150.07	147.32	147.80	142.84	143.17	145.92	145.90	145.04	144.67	
Std. Dev.	9.58	7.67	9.03	8.91	11.29	7.29	9.57	8.98	8.49	9.92	10.40	10.88	
Std. Err.	1.02	0.98	1.62	1.75	1.52	1.67	1.03	1.13	2.45	1.84	1.22	2.43	
Mass (wt) (kg) mean	39.92	37.60	42.13	42.22	41.75	41.75	38.16	39.22	41.00	41.33	38.65	39.76	
Std. Dev.	10.45	8.02	10.96	9.38	12.85	7.81	8.33	9.39	9.64	15.64	10.46	12.04	
Std. Err.	1.11	1.03	1.97	1.84	1.73	1.79	0.90	1.18	2.78	2.90	1.22	2.69	
Race - White	89	51	32	22	48	20	87	58	13	27	60	20	
- Black	1			5	8					3	14	1	
- Other		11						6					
Length of present residence 0-5 (years)	32	8	9	12	27	5	27	10	1	9	22	8	
6-10	8	33	12	5	13	4	17	28	5	5	22	3	
10 +	50	21	11	10	16	11	43	26	7	16	30	10	

TABLE 10

CHILDREN - Pulmonary function results
by regions

Sex and Region Pulmonary Function Results	GIRLS						BOYS					
	0	1	2	4	5	6	0	1	2	4	5	6
Forced vital capacity (FVC) - liters	2.20	2.13	2.46	2.55	2.40	2.36	2.43	2.38	2.48	2.64	2.46	2.43
Percent predicted FVC (PPFVC)	98.32	99.40	104.42	104.59	103.15	98.25	100.91	99.13	97.73	105.12	101.43	99.62
Forced expiratory volume (1 second) (FEV1) - liters	2.08	2.01	2.32	2.36	2.20	2.17	2.24	2.18	2.29	2.32	2.20	2.22
Percent predicted FEV1 (PPFEV1)	99.44	100.00	105.62	104.17	101.21	96.46	102.72	99.85	100.17	102.73	100.36	100.40
Forced Expiratory volume (3 seconds) (FEV3) - liters	2.00	1.83	2.13	2.14	2.01	1.96	2.16	1.94	2.08	2.21	2.12	2.05
Peak expiratory flow rate (PEFR) liters/second	4.74	4.70	5.13	5.16	4.84	4.65	4.87	4.91	5.29	5.00	5.01	4.85
Percent predicted PEFR	100.26	102.23	103.92	103.16	100.21	92.46	100.37	101.00	104.65	100.51	102.99	98.59
MF 50	3.26	3.19	3.64	3.57	3.24	3.22	3.23	3.08	3.25	3.24	3.11	3.14
MF 25	1.80	1.69	2.05	1.96	1.69	1.71	1.72	1.63	1.74	1.68	1.56	1.68
FEV1/FVC	0.95	0.95	0.95	0.93	0.92	0.92	0.93	0.92	0.93	0.89	0.90	0.92

TABLE II

SMOKING HISTORY OF MEN & WOMEN

Sex and Regions Smoking History	MEN						WOMEN					
	0	1	2	4	5	6	0	1	2	4	5	6
Presently smoking	55	41	16	15	28	6	59	33	12	18	33	10
Former Smokers	21	24	8	7	14	7	13	11	3	2	8	2
Never Smoked	19	17	3	7	8	5	34	40	15	13	27	12
Present smokers age began smoking (mean)	15.4	16.8	16.9	18.2	17.1	17	18.2	18.7	20.3	18.4	19.9	23.7
Std. Dev.	2.72	4.90	2.42	8.96	3.43	2.83	3.62	4.14	2.93	7.25	4.69	7.94
Std. Err.	0.37	0.78	0.62	2.40	0.66	1.26	0.48	0.73	0.88	1.76	0.83	2.65
Cigarettes/day (mean)	19.9	19.6	24.7	20.2	17.9	31.7	22.1	12.9	19.3	20.7	14.9	14.2
Std. Dev.	10.48	10.16	7.22	10.11	7.72	16.02	10.74	6.40	7.00	10.97	8.39	11.72
Std. Err.	1.43	1.61	1.86	2.70	1.49	7.16	1.41	1.13	2.11	2.66	1.48	3.91
Number of pack/years(mean)	16.4	16.3	26.2	18.1	18.1	22.2	13.2	10.5	12.9	14.1	12.1	12.2
Std. Dev.	11.60	10.27	15.01	10.27	10.96	10.04	11.06	7.14	8.91	8.38	8.49	8.4
Std. Err.	1.35	1.28	3.13	2.30	1.71	2.90	1.31	1.10	2.30	1.92	1.34	2.53

TABLE 12

RESPIRATORY SYMPTOMS - Adults
(A Typical Tabulation)

Sex and Region Questions	MEN						WOMEN					
	0	1	2	4	5	6	0	1	2	4	5	6
#30 - Cough in the morning												
yes	39	15	10	11	12	2	23	2	3	6	10	6
no	56	67	17	18	38	16	83	82	27	27	58	18
#34 - Morning Secretions												
yes	39	14	7	9	12	3	12	4	3	4	7	
no	56	68	20	20	38	15	94	80	27	29	61	24
#41 - Wheezing												
yes	50	21	12	10	24	8	31	13	4	10	23	6
no	45	61	15	19	26	10	75	71	26	23	45	18

TABLE 13
DISCRIMINANT ANALYSES

Region 1 compared with Regions 5, 6 combined.

	Run 1: Using measured dependent variables		Run 2: Using derived dependent variables	
<u>GROUP</u>	<u>ADULTS</u>	<u>CHILDREN</u>	<u>ADULTS</u>	<u>CHILDREN</u>
Variables included	PEFR Age FVC Cough Freq. People per household	Age People per household Cough freq. MF 50 FEV 0.75 FEV1 FVC PEFR	Age % pr. FEV1 Cough freq. Sex Height % pr. MF 50 Sickleave	Age People per household Cough freq. % pr. FEV1 Height % pr. MF 50
% classified correctly	70%	70%	70%	66%
% of variation accounted for	19%	21%	22%	18%

2. STATISTICAL ANALYSIS

Two principal statistical techniques were used:

- (1) discriminant analysis
- (2) multiple regression

The programmes used were from the SPSS (Statistical Package for the Social Sciences) listings, version 6.

2. (a) Discriminant Analysis

Using the discriminant analysis approach, a number of computer runs were made to try and find those variables that would best distinguish between regions. The regions chosen were located at the two known extremes of the pollution spectrum, i.e., region 1 (cleanest) vs regions 5 and 6 (dirtiest).

In the first approach, the variables tried were age, cough frequency, height, people per household, region of residence, length of residence, sex, smoking history and sickleave as well as the measured lung variables. TABLE 13 shows that through the discriminant analysis, only a few of the variables tested are retained as having a significant degree of discriminatory power.

The number of subjects correctly classified is 70% whether adults or children are concerned. However, the important fact is that very little (19 and 21%) of the sample variation is accounted for by the variables. In other words, the subjects in region 1 are not easily distinguishable from those in 5 and 6 using the variables listed above.

A second run using age, per cent predicted FEV, height, sex, cough frequency, sickleave, people per household, cigarettes smoked per year and per cent predicted FVC, PEFR, PMF 50, not unexpectedly, gave similar results (TABLE 13).

Subsequent discriminant analyses were done using household characteristics and health data. The results were also inconclusive.

2. (b) Regression Analysis

By multiple linear regression, it is possible to find those variable factors that best explain the variability in a dependent variable. Two methods of variable inclusion were used as in the following description.

(i) Simple Stepwise Inclusion: In this method, independent variables are entered in single steps in such a way that the variable that explains the greatest amount of variance in the dependent variable will enter first; the variable which explains the greatest amount of variance in conjunction with the first will enter second and so on.

(ii) Hierarchical Stepwise Inclusion: This method follows the simple stepwise inclusion pattern within each group as shown in TABLES 15 and 16 and its advantages are described in the section on conclusions.

The dependent variables selected were actual pulmonary test results for FVC, FEV1, FEV3, FEV 0.75, PEFR and MF 50. The independent variables entered were height, age, sex, length of residence, cough frequency, inability to perform duties because of illness, number of persons per household. The regions were entered as dummy variables with region 6 as reference region. TABLES 14-1 and 14-2 show the results of this first attempt where the cut-off point for independent variable inclusion was that where the regression coefficient no longer differed significantly from zero ($p \leq .05$).

A noteworthy finding is the appearance of the regions as contributing significantly to pulmonary function result variation in children.

As expected, age, height and sex in adults and height and sex in children are the major sources of variation in pulmonary function. Together, the other independent variables count for very little. In adults, smoking is a significant influence while regional differences do not seem to emerge as well as they do in the case of children.

Encouraged by these results, it was decided to rerun the tabulations in a combination stepwise-hierarchical fashion with all the non-region independent variables in one group followed by the regions in another. The children category was subdivided into girls and boys each as one group. In the case of adults, since smoking history was seen as a major variable influencing lung function, they were subdivided into three categories:

- (1) male (non-smokers at present)
- (2) female (non-smokers at present)
- (3) total adults (never smoked)

The conclusions of these analyses were as follows:

Adults - The results were not markedly different: elimination of the smoking factor did not result in increased regional differences.

Children - The regions (TABLES 15 and 16) show up strongly as factors of pulmonary function in boys. The advantage of hierarchical decomposition in that case is that tests of statistical significance can be made to determine the effect of all regions together on pulmonary functions. This can be done by comparing the per cent of variation accounted for prior to the introduction of the region into the equation with that after the regions were introduced and determining the significance of the difference. For example, in TABLE 15, it is seen that, in boys, there is 3.4% additional explained variation in FVC brought about by the introduction of regional effects. This 3.4% difference is significant with $p < 0.01$. Whenever $p < 0.05$, the results were termed "not significant". Figure 4 shows a plot of the difference between actual and predicted averages for FEV1 in boys.

For boys, the additions of the regions as variables accounts for a small but significant proportion of the explained variation in all functions except Peak Expiratory Flow Rate (PEFR). Moreover, it is noteworthy that for FEV1 and FEV 0.75, the regions in Sydney enter in the order which would correspond to the pollution gradients (from low to high).

For girls, FEV1 is the only dependent variable for which a significant amount of variation is explained by regional differences. Also, in the case of girls, the reader will observe that age is not a factor but height is. A physiological explanation for this can be found in the fact that as girls enter adolescence, their growth spurt occurs more rapidly and lasts less than boys of the same age range. In other words, the correlation between age and height is strong in boys throughout their teens but in girls, the degree of correlation tends to fade as their growth stops earlier.

For FEV1 in girls, another variable of significance ($p < 0.05$) is people per household. It would appear that girls who are shorter tend to live in larger families. We cannot interpret this observation except to speculate that socio-economic factors may be responsible for this phenomenon.

TABLE 14-1

REGRESSION ANALYSES

Dependent variables used in turn; independent variables all entered each time.
Effect of REGION only measurable relative to the highest pollution region (6).

ADULTS

Dep. Var.	<u>FVC</u>	<u>FEV 1</u>	<u>FEV 3</u>	<u>PEFR</u>	<u>MF 50</u>
Variables included (decreasing importance)	Height Age Sex Yrs of res. Smoking history	Age Height Sex Smoking history Cough freq.	Height Age Sex Smoking history Sickleave Yrs. of res. Reg. 1	Sex Age Height Smoking history Reg. 1 Cough freq. Yrs of res. Reg. 2	Smoking history Age Sex Height Cough freq.
% of variation accounted for	64%	62%	65%	63%	24%

TABLE 14-2

REGRESSION ANALYSES (cont'd)

CHILDREN

Dep. Var	<u>FVC</u>	<u>FEV1</u>	<u>FEV3</u>	<u>PEFR</u>	<u>MF 50</u>
Variables included (decreasing importance)	Height Sex Reg. 0 Yrs of res Reg. 2 Reg. 1 Reg. 4 Reg. 5	Height Sex Reg. 0 Reg. 1 Yrs of res Cough freq. Age People per household	Height Sex Reg. 0 Reg. 2 Yrs of res Reg. 1 Age Reg. 4 Reg. 5	Height Reg. 2 Sex Reg. 1 Reg. 0 Age Cough freq. Reg. 4 Reg. 5	Height Reg. 2 Reg. 1 Reg. 0 People per household Yrs of res
% of variation accounted for	71%	73%	64%	71%	38%

TABLE 15
PARAMETERS ACCOUNTING FOR SELECTED PULMONARY FUNCTIONS IN
ORDER OF DECREASING IMPORTANCE WITHIN GROUPS*

BOYS

	<u>FVC</u>	<u>FEV₁</u>	<u>FEV .75</u>	<u>PEFR</u>
Group 1:	Height	Height	Height	Height
	Age	Yrs of res.	Age	
Group 2:	Reg. 0	Reg. 0	Reg. 0	Reg. 2
	Reg. 1	Reg. 1	Reg. 1	Reg. 0
	Reg. 4	Reg. 2	Reg. 2	Reg. 1
	Reg. 2	Reg. 4	Reg. 4	
PERCENT EXPLAINED VARIATION:				
Group 1:	69.3	72.6	61.0	49.2
Groups 1 & 2:	<u>72.7</u>	<u>75.0</u>	<u>64.6</u>	<u>50.4</u>
Difference	<u>3.4</u>	<u>2.4</u>	<u>3.6</u>	<u>1.2</u>
Significance of Difference (<u>p</u>)	.01	.05	.05	NS

*Regression coefficients which did not differ significantly from zero (p0.5) have been omitted.

TABLE 16

PARAMETERS ACCOUNTING FOR SELECTED PULMONARY FUNCTIONS IN
ORDER OF DECREASING IMPORTANCE WITHIN GROUPS*

GIRLS

	<u>FVC</u>	<u>FEV1</u>	<u>FEV .75</u>	<u>PEFR</u>
Group 1:	Height	Height	Height	Height
	People per household	People per household	People per household	Cough freq.
Group 2:	Reg. 2	Reg. 2	None	Reg. 4
	Reg. 1	Reg. 4		
PERCENT EXPLAINED VARIATION:				
Group 1	69.0	70.9	63.8	49.3
Groups 1 & 2:	<u>69.8</u>	<u>72.3</u>	<u>64.9</u>	<u>51.5</u>
Difference	<u>0.8</u>	<u>1.4</u>	<u>1.1</u>	<u>1.2</u>
Significance of Difference (<u>p</u>)	NS	.05	NS	NS

*Regression coefficients which did not differ significantly from zero (p0.5)
have been omitted

Trend Prediction in Children

TABLE 17 shows the regression coefficients, which are significant, in prediction equations of the type

$$y = A (\text{height}) + B (\text{age}) + \text{constant}$$

<u>TABLE 17</u>				
<u>REGRESSION COEFFICIENTS</u>				
		<u>Age</u>	<u>Height</u>	<u>Constant</u>
<u>BOYS</u>	FVC	0.04122	0.04370	- 4.304
	FEV1	-	0.04032	- 3.586
	FEV 0.75	0.06986	0.03510	- 3.730
<u>GIRLS</u>	FEV1	-	0.03926	- 3.561

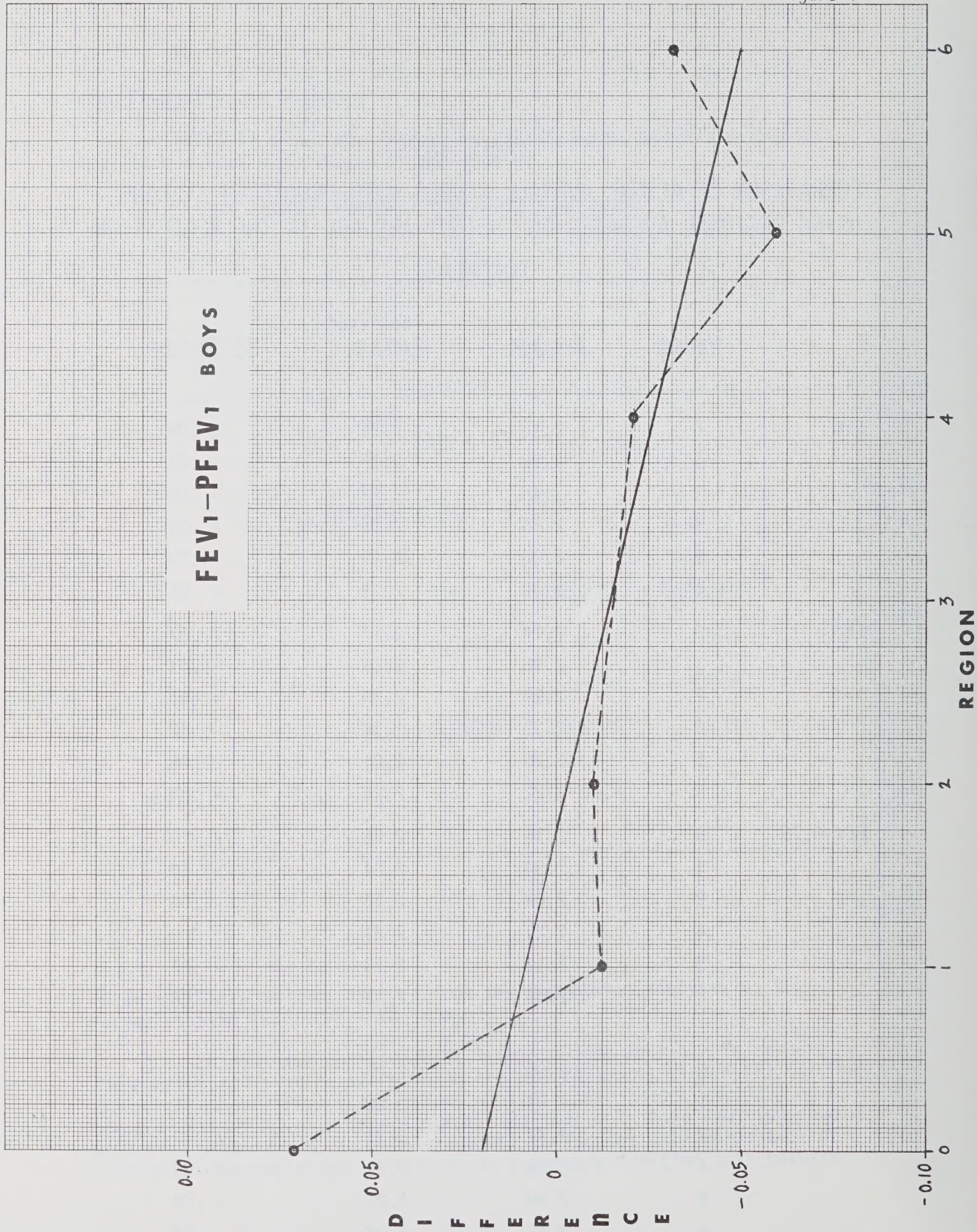
These coefficients were derived from the regression analyses on the survey results (289 boys - 287 girls).

Using these coefficients, it has become possible to compare those predicted average scores with the actual scores (TABLE 18); it appears that only FEV1 (boys) shows a significant trend ($p < 0.025$) across regions (Figure 4). It is not surprising that only that function should exhibit a clear trend since the regional influences only accounted for 2 or 3% of the explained variations in pulmonary function test results.

TABLE 18
COMPARISON OF ACTUAL AVERAGE SCORES WITH PREDICTED AVERAGES
USING REGIONAL AVERAGES FOR HEIGHT AND AGE IN THE REGRESSION
FORMULAS

	<u>Region</u>	<u>Actual Average</u>	<u>Predicted Average</u>	<u>Difference</u>
<u>BOYS</u>				
FVC	0	2.43	2.39	✓ .04
	1	2.38	2.39	- .01
	2	2.48	2.52	- .05
	4	2.64	2.55	✓ .09
	5	2.46	2.49	- .03
	6	2.43	2.48	- .05
FEV 1	0	2.24	2.17	✓ .07
	1	2.18	2.19	- .01
	2	2.29	2.30	- .01
	4	2.32	2.30	- .02
	5	2.20	2.26	- .06
	6	2.22	2.25	- .03
FEV 0.75	0	2.16	2.06	✓ .10
	1	1.94	2.04	- .10
	2	2.08	2.16	- .08
	4	2.21	2.21	0
	5	2.12	2.13	- .01
	6	2.05	2.13	- .08
<u>GIRLS</u>				
FEV 1	0	2.08	2.08	0
	1	2.01	2.02	- .01
	2	2.32	2.21	✓ .11
	4	2.36	2.33	✓ .03
	5	2.20	2.22	- .02
	6	2.17	2.24	- .07

Figure 4



2. (d) Ear, Nose and Throat Results and Statistical Analysis

The same physician examined all the children for ear, nose and throat problems. The actual results are given in TABLES 19, 20 and 21.

Chi-square tests were made to determine the significance of regional differences. Because many of the cells in the tabulations contained small numbers, it became necessary to combine certain regions and/or conditions. Thus, regions 1 and 2 were combined in view of the small number of subjects in region 2. Since the air pollution characteristics of New Waterford were not as clearly defined as those of Sydney, chi-square tests were made for

- (a) regions 0 - 6
- (b) regions 1, 2, 3, 4, 5, 6

A description of these results follows:

EAR

Because of problems of small numbers in certain categories, the ear conditions were rearranged in three categories (see TABLE 22):

- (1) normal
- (2) obscured, scarred, present problem
- (3) scarred

Expected values for the cells in each region were obtained by:

1. pro-rating the figures according to the percentages for the total for regions 0 - 6, and
2. pro-rating the figures according to the percentages for the totals for regions 1, 2, 3, 4, 5, 6 for all regions except 0. The chi-square values were then calculated and the results are shown on TABLE 23.

NOSE

There were very few nasal problems encountered. Consequently, it became necessary to regroup all cases in two categories, i.e., normal and abnormal, with the latter embracing conditions 2 to 5 (see TABLE 24).

Results of the chi-square tests showed some degree of significance (TABLE 25).

No significant differences for boys are shown between regions but the differences do appear to be real for total children and for girls in regions 1, 2-6. TABLE 3 shows that region 5 is the worst one for health status of the nose and for boys, girls and total children, the percentages are approximately the same. Outside of this region, girls, on the whole, seem to have healthier noses than boys and this phenomenon accounts for the lower probabilities for girls and all children as compared to boys.

THROAT

As in the previous case, it was necessary to regroup the data in two groups: abnormal and normal. In the new normal category were put both initial category 1 (normal) and the initial category 3 (tonsils absent, throat normal). Former categories 2, 4 and 5 were redefined as abnormal (see TABLE 26). TABLE 27 gives the results of its chi-square test.

The significance observed in the regions 0 - 6 test arises from the high incidence of abnormal throats in region 0. Perhaps there was an epidemic of sore throats at the time of the examination in New Waterford.

2. (e) Questions 67 - 72 -- Results and Statistical Analysis

Questions 67 and 72, page 8 of the questionnaire were intended to address directly the incidence of illness and/or absenteeism. Chi-square testing was done using the contingency tables of TABLES 28 and 29.

For question 67, significant differences were noted for all categories but, in the case of boys, regions 5 and 6 stood out against the others as worse. In the case of girls, region 1 stood out instead.

For question 72, no category or region seemed to indicate any significant differences.

TABLE 19
EAR CONDITIONS - Children

Sex Region	GIRLS								BOYS					
	0	1	2	4	5	6			0	1	2	4	5	6
Condition														
1) Normal	47	36	18	17	25	11			47	36	11	19	47	9
2) Obscured or Scarred & Obscured	32	17	12	6	18	6			17	19	2	9	20	8
3) Scarred	11	5	1	4	13	3			22	7	-	2	7	4
4) Problem now (perforated or otitis or fluid)	1	-	-	-	-	-			-	-	-	-	-	-
5) Uncooperative	-	-	1	-	-	-			-	-	-	-	-	-

TABLE 20
THROAT CONDITIONS - Children

Sex Region Condition	GIRLS							BOYS					
	0	1	2	4	5	6		0	1	2	4	5	6
1) Tonsil normal	40	34	24	18	41	11		47	44	9	17	58	14
2) Tonsil present but inflamed	1	1	-	1	-	1		-	-	-	-	-	-
3) Tonsil absent, throat normal	12	6	3	4	-	3		10	3	3	4	6	2
4) Tonsil absent, throat inflamed	1	-	-	-	-	-		-	-	-	-	-	1
5) Other problems	36	17	4	4	14	5		29	15	1	9	10	4
6) Uncooperative	-	-	1	-	1	-		-	-	-	-	-	-

TABLE 21

NOSE CONDITIONS - Children

Sex Region Condition	GIRLS						BOYS					
	0	1	2	4	5	6	0	1	2	4	5	6
1) Normal	83	57	31	25	49	18	79	60	11	27	64	19
2) Septum Problem	3	-	-	1	4	1	4	1	-	2	2	-
3) Acute Problem	2	-	-	-	2	1	2	1	-	1	2	1
4) Chronic Problem	2	-	-	-	-	-	1	-	2	-	6	1
5) Acute & Chronic	-	1	-	1	1	-	-	-	-	-	-	-
6) Uncooperative	-	-	1	-	-	-	-	-	-	-	-	-

TABLE 22

CONTINGENCY TABLE OF EAR CONDITIONS FOR BOYS AND GIRLS

- PERCENTAGES IN BRACKETS TO THE RIGHT

Category	Reas. 0-6	Req. 0	Regs. 1,2-6	Req. 1,2	Req. 4	Req. 5	Req. 6
<u>Boys</u>							
1	169 (59.1)	47 (54.7)	122 (61.0)	47 (62.7)	19 (63.3)	47 (63.5)	9 (42.9)
2	75 (26.2)	17 (19.8)	58 (29.0)	21 (28.0)	9 (30.0)	20 (27.0)	8 (38.1)
3	42 (14.7)	22 (25.6)	20 (10.0)	7 (9.3)	2 (6.7)	7 (9.5)	4 (19.0)
TOTAL	286 (100.0)	86 (100.0)	200 (100.0)	75 (100.0)	30 (100.0)	74 (100.0)	21 (100.0)
<u>Girls</u>							
1	154 (54.6)	47 (52.2)	107 (55.7)	54 (60.7)	17 (63.0)	25 (44.6)	11 (55.0)
2	91 (32.3)	32 (35.6)	59 (30.7)	29 (32.6)	6 (22.2)	18 (32.1)	30 (30.0)
3	37 (13.1)	11 (12.2)	26 (13.5)	6 (6.7)	4 (14.8)	13 (23.2)	15 (15.0)
TOTAL	282 (100.0)	90 (100.0)	192 (100.0)	89 (100.0)	27 (100.0)	56 (99.9)	20 (100.0)
<u>Boys & Girls</u>							
1	323 (56.9)	94 (53.4)	229 (58.4)	101 (61.6)	36 (63.2)	72 (55.4)	20 (48.8)
2	166 (29.2)	49 (27.8)	117 (29.8)	50 (30.5)	15 (26.3)	38 (29.2)	14 (34.1)
3	79 (13.9)	33 (18.8)	46 (11.7)	13 (7.9)	6 (10.5)	20 (15.4)	7 (17.1)
TOTAL	568 (100.0)	176 (100.0)	392 (100.0)	164 (100.0)	57 (100.0)	130 (100.0)	41 (100.0)

Definition Category: 1 - normal
 2 - obscured, scarred, present problem
 3 - scarred

TABLE 23
X² VALUES FOR FIGURES IN TABLE 1

	x^2	Degrees of Freedom	Prob. x^2 Exceeded
<u>REGIONS 0-6</u>			
Boys	6.909	8	.50
Girls	12.362	8	.14
All Children	10.087	8	.26
<u>REGIONS 1,2-6</u>			
Boys	4.113	6	.66
Girls	9.628	6	.14
All Children	6.458	6	.37

Differences in ear conditions were not statistically significant.

TABLE 24
CONTINGENCY TABLE OF NOSE CONDITIONS FOR BOYS AND GIRLS
- PERCENTAGES IN BRACKETS TO THE RIGHT

Category	Regs. 0-6	Reg. 0	Regs. 1,2-6	Regs. 1,2	Reg. 4	Reg. 5	Reg. 6
<u>Boys</u>							
Normal	260 (90.9)	79 (91.9)	181 (90.5)	71 (94.7)	27 (90.0)	64 (86.5)	19 (90.5)
Abnormal	26 (9.1)	7 (8.1)	19 (9.5)	4 (5.3)	3 (10.0)	10 (13.5)	2 (9.5)
TOTAL	286 (100.0)	86 (100.0)	200 (100.0)	75 (100.0)	30 (100.0)	74 (100.0)	21 (100.0)
<u>Girls</u>							
Normal	263 (93.3)	83 (92.2)	180 (93.7)	88 (98.9)	25 (92.6)	49 (87.5)	18 (90.0)
Abnormal	19 (6.7)	7 (7.8)	12 (6.3)	1 (1.1)	2 (7.4)	7 (12.5)	2 (10.0)
TOTAL	282 (100.0)	90 (100.0)	192 (100.0)	89 (100.0)	27 (100.0)	56 (100.0)	20 (100.0)
<u>All Children</u>							
Normal	523 (92.1)	162 (92.0)	361 (92.1)	159 (97.0)	52 (91.2)	113 (86.9)	37 (90.2)
Abnormal	45 (7.9)	14 (8.0)	31 (7.9)	5 (3.0)	5 (8.8)	17 (13.1)	4 (9.8)
TOTAL	568 (100.0)	176 (100.0)	392 (100.0)	164 (100.0)	57 (100.0)	130 (100.0)	41 (100.0)

TABLE 25

χ^2 VALUES FOR FIGURES IN TABLE 24

	χ^2	Degrees of Freedom	Prob. χ^2 Exceeded
<u>REGIONS 0-6</u>			
Boys	3.162	4	.53
Girls	7.936	4	.09
All Children	10.320	4	.04 (S)
<u>REGIONS 1,2-6</u>			
Boys	2.910	3	.41
Girls	8.267	3	.04 (S)
All Children	10.337	3	.02

TABLE 26
CONTINGENCY TABLE OF THROAT CONDITIONS FOR BOYS AND GIRLS
- PERCENTAGES IN BRACKETS TO THE RIGHT

Category	Regs. 0-6	Reg. 0	Regs. 1,2-6	Regs. 1,2	Reg. 4	Reg. 5	Reg. 6
<u>Boys</u>							
Normal	217 (75.9)	57 (66.3)	160 (80.0)	59 (78.7)	21 (70.0)	64 (86.5)	16 (76.2)
Abnormal	69 (24.1)	29 (33.7)	40 (20.0)	16 (21.3)	9 (30.0)	10 (13.5)	5 (23.8)
TOTAL	286 (100.0)	86 (100.0)	200 (100.0)	75 (100.0)	30 (100.0)	74 (100.0)	21 (100.0)
<u>Girls</u>							
Normal	196 (69.8)	52 (57.8)	144 (75.4)	67 (75.3)	22 (81.5)	41 (74.5)	14 (70.0)
Abnormal	85 (30.2)	38 (42.2)	47 (24.6)	22 (24.7)	5 (18.5)	14 (25.5)	6 (30.0)
TOTAL	281 (100.0)	90 (100.0)	191 (100.0)	89 (100.0)	27 (100.0)	55 (100.0)	20 (100.0)
<u>All Children</u>							
Normal	413 (72.8)	109 (61.9)	304 (77.7)	126 (76.8)	43 (75.4)	105 (81.4)	30 (73.2)
Abnormal	154 (27.2)	67 (38.1)	87 (22.3)	38 (23.2)	14 (24.6)	24 (18.6)	11 (26.8)
TOTAL	567 (100.0)	176 (100.0)	391 (100.0)	164 (100.0)	57 (100.0)	129 (100.0)	41 (100.0)

TABLE 27

χ^2 VALUES FOR FIGURES IN TABLE 26

	χ^2	Degrees of Freedom	Prob. χ^2 Exceeded
<u>REGIONS 0-6</u>			
Boys	9.764	4	.045 (S)
Girls	9.766	4	.045 (S)
All Children	16.875	4	.002 (S)
<u>REGIONS 1,2-6</u>			
Boys	4.095	3	.25
Girls	.875	3	.83
All Children	1.744	3	.63

TABLE 28
SYDNEY RESPIRATORY HEALTH SURVEY CONTINGENCY TESTS FOR SELECTED QUESTIONS
- PERCENTAGES IN BRACKETS TO THE RIGHT

Question 67 - SICKLEAVE						
Category	Region 0	Region 1	Regions 2,4	Regions 5,6	Total	χ^2
<u>Boys</u>						
1	52 (60.0)	34 (53.1)	29 (67.4)	42 (44.2)	157 (54.3)	13.515
2	19 (21.9)	11 (17.2)	4 (9.3)	16 (16.8)	50 (17.3)	p < .04
3 and 4	16 (18.4)	19 (23.3)	10 (23.3)	37 (38.9)	82 (28.4)	S
TOTAL	87	64	43	95	289	
<u>Girls</u>						
1	70 (77.8)	22 (35.5)	31 (52.5)	36 (47.4)	159 (55.4)	35.234
2	12 (13.3)	11 (17.7)	11 (18.6)	15 (19.7)	49 (17.1)	p < .000 004
3 and 4	8 (8.9)	29 (46.8)	17 (28.8)	25 (33.0)	79 (27.5)	HS
TOTAL	90	62	59	76	287	
<u>Boys & Girls</u>						
1	122 (68.9)	56 (44.4)	60 (58.8)	78 (45.6)	316 (54.9)	34.358
2	31 (17.5)	22 (17.5)	15 (14.7)	31 (18.1)	99 (17.2)	p < .000 006
3 and 4	24 (13.6)	48 (38.1)	27 (26.5)	62 (36.3)	161 (28.0)	HS
TOTAL	177	126	102	171	576	

LEGEND: NS: Not Significant
S: Significant (p < .05 but > .01)
HS: Highly Significant (p < .01)

TABLE 29

SYDNEY RESPIRATORY HEALTH SURVEY CONTINGENCY TESTS FOR SELECTED QUESTIONS
- PERCENTAGES IN BRACKETS TO THE RIGHT

Question 72: Misswork (School)						χ^2
Category	Region 0	Region 1	Regions 2,4	Regions 5,6	Total	
<u>Boys</u>						
1	12 (13.8)	15 (23.4)	9 (20.9)	23 (24.2)	59 (20.4)	13.773
2	45 (51.7)	34 (53.1)	21 (48.8)	38 (40.0)	138 (47.8)	$p \leq .13$
3	17 (19.6)	12 (18.8)	4 (9.3)	15 (15.8)	48 (16.6)	
4 and 5	13 (14.9)	3 (4.7)	9 (20.9)	19 (20.0)	44 (15.2)	NS
TOTAL	87	64	43	95	289	
<u>Girls</u>						
1	16 (17.8)	6 (9.7)	11 (18.6)	20 (26.3)	53 (18.5)	12.278
2	42 (46.7)	32 (51.6)	35 (59.3)	33 (43.4)	142 (49.5)	$p \leq .20$
3	18 (20.0)	12 (19.4)	8 (13.6)	16 (21.1)	54 (18.8)	
4 and 5	14 (15.6)	12 (19.4)	5 (8.5)	7 (9.2)	38 (13.2)	NS
TOTAL	90	62	59	76	287	
<u>Boys & Girls</u>						
1	28 (15.8)	21 (16.7)	20 (19.6)	43 (25.1)	112 (19.4)	10.882
2	87 (49.2)	66 (52.4)	56 (54.9)	71 (41.5)	280 (48.6)	$p \leq .28$
3	35 (19.8)	24 (19.0)	12 (11.8)	31 (18.1)	102 (17.7)	
4 and 5	27 (15.3)	15 (11.9)	14 (13.7)	26 (15.2)	82 (14.2)	NS
TOTAL	177	126	102	171	576	

LEGEND: NS: Not Significant
S: Significant ($p \leq .05$ but $> .01$)
HS: Highly Significant ($p \leq .01$)

VI - DISCUSSION AND CONCLUSION

This prevalence study of respiratory health in residents of Sydney and New Waterford was designed to ascertain the presence and magnitude of health effects associated with air pollution.

The results indicate that pulmonary measurements in school children provide the most sensitive indicator of this. Indeed, multiple regression analysis established that residence in any one of the defined pollution zones, contributes significantly to the variability of measurements of forced vital capacity (FVC), forced expiratory volume at 1 and 0.75 second (FEV₁, FEV_{0.75}) and peak expiratory flow rate (PEFR). However, the amounts by which these parameters differ by regions are small.

In the case of FEV₁ in boys, comparisons between predicted and actual mean values for regions 5 and 6 (Ref. TABLE 18) give respectively differences of -0.06 and -0.03 litres. As percentages of the predicted values, these become 2.7% and 1.3% respectively. This pulmonary function test is a measure of how much air can be forcefully expelled from the lungs in one second. Inasmuch as the interpretation of these differences in terms of public health is concerned, it should be emphasized that these small differences do not indicate the presence of disease; rather, they indicate a decrement in the fitness of the respiratory system. These small differences also testify to the ability of this particular survey instrument to detect very small variations in lung function parameters.

From the answers to the questionnaire, there is no conclusive evidence of a similar trend from high pollution to low pollution regions in terms of respiratory symptoms or illnesses. This absence of a uniform trend becomes particularly notable when, in question 67, it appears that it is those girls who live in the "cleanest" region (no. 1) of Sydney that report the highest incidence of respiratory illness. It is of interest to note, however, that the "excess" illness reported in response to question 67 does not result in a parallel excess in school absenteeism in response to question 72. It is difficult to explain this unless one supposes that the extra "illness" took place during the vacation periods!

Ear, nose and throat examination results do not strengthen an argument for a relationship to air pollution despite the extensive statistical analyses applied to these results. At the most, one can suspect an epidemic of sore throats when New Waterford school children were examined.

The results from the adult population survey were not unexpected. The influence of smoking as a factor of pulmonary function showed up with great regularity in both discriminant and regression analyses. Attempts

to separate smokers and former smokers from those who have never smoked did not succeed in extracting regional differences of statistical significance. This is not surprising in view of other occupational factors which would still have to be accounted for. It is noteworthy that the mean population predicted values in adults were close to 100%, the expected value of a "normal" population as defined by the Yale University Lung Research Centre prediction equations.

For the purposes of the survey, however, the results from the school children population are sufficient to demonstrate a connection between respiratory function and place of residence, our chosen index of exposure to air pollution.

The household and lifestyle data acquired in the appropriate questionnaire sections did not, in our statistical analyses, permit an adequate discrimination between regions. This does not necessarily mean, however, the absence of a socio-economic gradient based on level of education or income, two aspects that would require extensive additional study.

While additional environmental measurements would be in order to better define the air pollution status of New Waterford, the overall impression from the existing measurements is that it is not as "clean" as the "cleanest" region in Sydney. Rather, New Waterford would appear to be an intermediate pollution zone not unlike Sydney region 4. Yet, in terms of pulmonary function results, the New Waterford children scored generally as well as those living in Sydney's "cleanest" region. This would seem to indicate that other factors, perhaps socio-economic, are also playing a role here.

With respect to practical recommendations on the adequacy of present maximum acceptable objectives for SO₂ and suspended particulate matter to protect health, the survey results reinforce the opinion that they cannot be exceeded, as it has been the case in Sydney for some time, without having some measurable negative effect on respiratory function.

VI - DISCUSSION ET CONCLUSION

Cette étude de la prévalence de la santé de l'appareil respiratoire chez les résidents de Sydney et de New Waterford a été conçue dans le but de déterminer si la pollution atmosphérique porte atteinte à la santé et, dans l'affirmative, la portée de cette atteinte.

Les résultats indiquent que la mesure de la fonction pulmonaire chez les écoliers en constitue l'indicateur le plus sensible. L'analyse de régression multiple a en effet permis d'établir que la résidence dans l'une ou l'autre des zones de pollution définies contribue de manière significative à la variabilité des mesures de la capacité pulmonaire en expiration forcée (FVC), du volume d'air chassé en expiration forcée à 1 et à 0.75 seconde (FEV1 et FEV 0.75) et de débit pulmonaire de crête en expiration (PEFR). Cependant, la valeur de ces paramètres ne variait guère d'une région à l'autre.

Dans le cas de la valeur FEV 1 chez les garçons, les comparaisons entre les valeurs moyennes prévues et les valeurs effectives pour les régions 5 et 6 (TABLEAU 18) donnent respectivement des différences de -0.06 et -0.03 litre. Ces différences équivalent à 2.7 et 1.3% respectivement des valeurs prévues. Ce test n'est qu'une mesure de la quantité d'air pouvant être chassée des poumons pendant une seconde, et il y a lieu de souligner qu'en ce qui concerne la santé publique, ces différences mineures ne traduisent pas la présence de la maladie. Elles indiquent plutôt une détérioration de l'état respiratoire. Ces différences mineures témoignent également de la capacité de cet instrument d'enquête particulier de déceler des variations très minimes dans les paramètres respiratoires.

Les réponses au questionnaire, en ce qui concerne les symptômes ou les maladies respiratoires, ne révèlent pas de manière concluante l'existence d'une tendance semblable en partant des régions de pollution élevée et en allant vers les régions de faible pollution. L'absence d'une tendance uniforme ressort particulièrement bien des réponses données à la question 67, qui semblent montrer que les maladies respiratoires sont plus fréquentes chez les filles vivant dans la région désignée "la plus propre" (région n° 1) de Sydney. Il est intéressant de constater, cependant, que cet "excès" de maladie mis en évidence par les réponses à la question 67 n'entraîne pas un "excès"

correspondant d'absentéisme scolaire, selon les réponses à la question 72, ce qui s'explique difficilement, à moins de supposer que les dits "excès" de maladies se soient manifestés en périodes de vacances.

Les résultats des examens oto-rhino-laryngologiques n'appuient aucunement l'existence d'un rapport avec la pollution de l'air, en dépit des analyses statistiques approfondies qui ont été effectuées sur ces résultats. On peut tout au plus soupçonner qu'une épidémie de mal de gorge sévissait à New Waterford au moment où les écoliers ont été examinés.

Les résultats de l'enquête effectuée sur la population adulte n'étaient pas inattendus. L'influence de l'habitude du tabac sur la fonction pulmonaire ressort avec une grande régularité dans les analyses des discriminants et de régression. Les efforts visant à établir une distinction entre les fumeurs et les anciens fumeurs d'une part et ceux qui n'avaient jamais fumé d'autre part n'ont pas réussi à mettre en évidence des différences régionales statistiquement significatives. Cela n'a rien de surprenant, vu les autres facteurs professionnels dont il faudrait tenir compte. Il y a lieu de noter que les valeurs moyennes prévues pour la population d'adultes étaient voisines de 100%, la valeur prévue pour une population "normale" était celle définie par les équations de prédiction du centre de recherche pulmonaire de l'Université Yale.

Pour les fins de l'étude, cependant, les résultats obtenus pour la population d'écoliers sont suffisants pour démontrer l'existence d'un rapport entre la fonction respiratoire et le lieu de domicile, lesquels résultats constituent l'indice que nous avons choisi pour représenter l'exposition à la pollution de l'air.

Les données relatives au foyer et au style de vie obtenues dans les sections appropriées du questionnaire étaient insuffisantes pour établir, au moyen d'analyses statistiques, des différences entre les diverses régions. Cela ne signifie pas nécessairement qu'il n'existe pas de gradient socio-économique, en fonction du niveau d'éducation ou du revenu, deux facteurs qui devraient être approfondis davantage.

Bien qu'il serait souhaitable, pour obtenir une évaluation plus précise du degré de pollution de l'air à New Waterford, d'effectuer des mesures additionnelles, il semble en général que l'air de cette localité ne soit pas aussi "propre" que celui du quartier désigné "le plus propre" de Sydney. Il semble plutôt que New Waterford soit une zone intermédiaire, semblable à la région n° 4 de Sydney. Néanmoins,

en ce qui concerne les examens de la fonction pulmonaire les résultats obtenus pour les enfants de New Waterford étaient généralement aussi favorables que ceux pour les enfants demeurant dans le quartier désigné "le plus propre" de Sydney. Cela semble indiquer que d'autres facteurs, peut-être d'ordre socio-économique, jouent également un rôle à cet égard.

Quant à savoir s'il y a lieu de changer les limites maximales admissibles appliquées présentement pour le SO_2 et les particules en suspension, les résultats de l'enquête corroborent l'opinion selon laquelle celles-ci ne peuvent être dépassées, comme cela se produit à Sydney depuis assez longtemps, sans que la fonction respiratoire ne s'en trouve affectée dans les proportions mesurables.

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VIII - APPENDIX

(SURVEY QUESTIONNAIRE)

SYDNEY RESPIRATORY HEALTH SURVEY

IDENTIFICATION DATA

1. A) Name:

Home address:

Telephone no.:

B) How long have you been living at the present location?

- 1) 1 year
- 2) 2 years
- 3) 3 years
- 4) 4 years
- 5) 5 years
- 6) 6-10 years
- 7) more than 10
years

C) Where were you living before?

Address:

D) How long did you live at your former location?

- 1) 1 year
- 2) 2 years
- 3) 3 years
- 4) 4 years
- 5) 5 years
- 6) 6-10 years
- 7) more than 10
years

2. For Children Only:

School name:

Grade:

3. Social insurance no.: (if none, please write none)

4. Family physician name:

FOR
OFFICIAL
USE
ONLY

5. Standing Height cm:

6. Sitting Height cm:

7. Body Mass kg:

8. How old are you?

9. What is your birth date? (enter 6 digits)

year

month

day

10. Sex (circle appropriate)

1. male 2. female

OCCUPATION

28. Which of the following best describe your occupation for the last three (3) years?

1. Student
2. Housewife
3. Office worker at the steel co.
4. Plant worker at the steel mill
5. Plant worker in the coke ovens
6. Underground work at the coal mine
7. Surface work at the coal mine
8. Other (Specify)

29. If you worked for more than three (3) years at locations 3, 4, 5, 6, 7 or 8 of the above question (28) please indicate the location and period:

DATES (years)

<u>Location</u>	<u>From</u>	<u>To</u>	<u>no. of years</u>
Office worker at the steel mill			
Plant worker at the steel mill			
Plant worker in the coke ovens			
Underground work at the coal mine			
Surface work at the coal mine			
Other (please specify)			

SYMPTOMS

SOME QUESTIONS ABOUT COUGH

30. Do you usually cough first thing in the morning? 1. yes 2. no
31. Do you usually cough at other times during the day or night? 1. yes 2. no
- (If 'no' to 30 and 31 please skip to 34)
32. Do you cough on most days for as much as 3 months of the year? 1. yes 2. no
33. For how many years have you had this cough? 1. less than 2 years
2. 2-5 years
3. more than 5 years

SOME QUESTIONS ABOUT PHLEGM, SPUTUM OR MUCUS WHICH COMES FROM YOUR CHEST.

34. Do you usually bring up (phlegm) (sputum) or (mucus) from your chest first thing in the morning? 1. yes 2. no
35. Do you usually bring up (phlegm) (sputum) or (mucus) from your chest at other times during the day or night? 1. yes 2. no
- (If 'yes' to 34 or 35, go to 36-39)
36. Do you bring up (phlegm) (sputum) or (mucus) from your chest on most days for as much as 3 months of the year? 1. yes 2. no
37. For how many years have you raised (phlegm) (sputum) or (mucus) from your chest? 1. less than 2 years
2. 2-5 years
3. more than 5 years
38. What is the usual color of the (phlegm) (sputum) or (mucus) you bring up from your chest? 1. don't know
2. clear
3. white
4. other
5. yellow
6. green
- (If 1, 2, 3 or 4 go to 39)
39. Have you ever had episodes of yellow or green (phlegm) (sputum) or (mucus)? 1. yes 2. no
40. Have you ever coughed up blood? 1. yes 2. no
- (If 'yes' please specify)

SOME QUESTIONS ABOUT WHEEZING, WHISTLING AND TIGHTNESS IN YOUR CHEST

41. Have you ever noticed any wheezing or whistling or any tightness in your chest? 1. yes 2. no
- (If 'no' to 41, skip to 65)

42. Which of these symptoms have you experienced:
wheezing or tightness or both?
1. only wheezing
 2. only chest tightness
 3. mainly wheezing
 4. mainly chest tightness
 5. both wheezing and chest tightness
43. At what age did your (wheezing) (whistling) or (chest tightness) first occur?
- _____
44. When did this (wheezing) (whistling) or (chest tightness) last occur?
1. within the last 4 weeks
 2. within the last 12 months
 3. more than 1 year ago but less than 5 years ago
 4. more than 5 years ago
45. How often have you experience this (wheezing) (whistling) or (chest tightness)?
1. usually at least once a day or night
 2. only a few times each week
 3. only a few times each month
 4. only a few times each year
 5. only a few times ever
 6. only once
- (If answer is 5 or 6 to 45 skip to 65)
46. (Does) or (did) your (wheezing) (whistling) or (chest tightness) occur with colds or sore throats?
1. yes
 2. no
47. (Does) or (did) your (wheezing) (whistling) or (chest tightness) occur with episodes of increased phlegm from your chest?
1. yes
 2. no
48. (Is) or (was) your (wheezing) (whistling) or (chest tightness) associated with attacks of shortness of breath?
1. yes
 2. no
- (Is) or (was) your (wheezing) (whistling) or (chest tightness) brought on by, or made worse by exposure to:
49. Dusts or fumes originating in the home?
1. yes
 2. no
50. Dusts or fumes in the air outside?
1. yes
 2. no
51. Contact with animals?
(If 'yes' please specify)
1. yes
 2. no
52. Plants or pollens?
(If 'yes' please specify)
1. yes
 2. no

53. Dusts, gases or fumes at work? 1. yes 2. no
(If 'yes' please specify)
54. Tobacco smoke? 1. yes 2. no
55. (Are) or (were) there any other factors which bring on your (wheezing) (whistling) or (chest tightness)? (If 'yes' please specify) 1. yes 2. no
56. (Is) or (was) your (wheezing) (whistling) or (chest tightness) worse on any particular day or days of the week? In other words, is there any difference between, say, Friday, Monday, Sunday or Thursday? 1. yes 2. no
(If 'no' to 56, go to 59)
57. On which day or days is it worse? 1. first day back at work
2. other day(s) at work
3. weekends
58. Did this worsening occur sometimes or always? 1. sometimes 2. always
59. (Is) or (was) your (wheezing) (whistling) or (chest tightness) better on any particular day or days of the week or weekend? 1. yes 2. no
(If 'no' to 59, go to 61)
60. When is it better? 1. weekday 2. weekend
61. (Is) or (was) your (wheezing) (whistling) or (chest tightness) better, the same or worse when you go on a vacation trip? 1. better
2. the same
3. worse
4. no vacation
62. (Is) or (was) your (wheezing) (whistling) or (chest tightness) worse during a particular season? 1. yes 2. no
(If 'no' to 62, go to 65)
63. Which (is) or (was) the worst season? 1. winter
2. spring
3. summer
4. fall
64. (Do) or (did) these symptoms occur only during this season? 1. yes 2. no

SOME QUESTIONS ABOUT BREATHLESSNESS

65. Are you troubled by shortness of breath when
running on level ground or walking up a stairway? 1. yes 2. no
66. Do you think that you get short of breath more
quickly than others of your own age? 1. yes 2. no

HISTORY OF ILLNESS

SOME QUESTIONS ABOUT RESPIRATORY ILLNESS

67. During the past 3 years, how often were you unable to do your usual activities because of such illnesses (chest colds, bronchitis or pneumonia)?
1. never
 2. once
 3. 2-5 times
 4. more than 5 times
68. Have you had your tonsils removed?
1. yes
 2. no
69. In the last 3 years, have you ever been hospitalized due to illness? (Pregnancy excluded)
1. yes
 2. no
70. Is a physician treating you now?
(If 'yes' please specify for what)
1. yes
 2. no
71. Are you taking medication now?
(If 'yes' please specify)
1. yes
 2. no
72. How many days of work or school did you miss last year due to illness? (approximately)
1. 0 day
 2. 1-5 days
 3. 6-10 days
 4. 10-20 days
 5. 21 days or more

A FEW QUESTIONS ABOUT SOME OTHER DISEASES

73. Have you ever had hives?
1. yes
 2. no
74. Did you have eczema as an infant?
1. yes
 2. no
75. Have you ever had eczema in the creases of the elbows or knees?
1. yes
 2. no
76. Have you ever had any food allergies?
(If 'yes' please specify)
1. yes
 2. no
77. Have you ever had any allergies to drugs, such as penicillin or sulfa?
1. yes
 2. no
78. How often do you have episodes of sneezing or "runny nose", such as in colds or hay fever?

(If answers 1-4, go to 79)
(If answers 5-6, go to 87)
1. usually at least once a day or night
 2. only a few times each week
 3. only a few times each month
 4. only a few times each year
 5. only a few times ever
 6. never

(Is) or (was) your episodes of sneezing or "runny nose" brought on by, or made worse by exposure to:

79. Dusts or fumes originating in the home? 1. yes 2. no
80. Dusts or fumes in the air outside? 1. yes 2. no
81. Contact with animals? 1. yes 2. no
(If 'yes' please specify)
82. Plants or pollens? 1. yes 2. no
(If 'yes' please specify)
83. Are there any other factors which bring on your sneezing or "runny nose"? 1. yes 2. no
(If 'yes' please specify)
84. Is your sneezing or "runny nose" worse during a particular season? 1. yes 2. no
(If 'no' go to 86)
85. Which is the worst season? 1. winter
2. spring
3. summer
4. fall
86. Do these symptoms occur only during this season? 1. yes 2. no

SMOKING HISTORY

NOW SOME QUESTIONS ABOUT SMOKING

87. Do you now smoke cigarettes (even occasionally)? 1. yes 2. no
(If no, skip to 94)
88. Do you smoke cigarettes with or without filters? 1. with filters
2. without filters
3. both with and without filters
89. Do you inhale? 1. yes 2. no
90. How old were you when you began to smoke cigarettes? _____ age
91. How many cigarettes do you usually smoke each day at the present time? _____ number per day
92. At what age did you start smoking this many? _____ age
93. Please fill in the table all of your smoking history as per example shown below.

Cigarettes smoked per day	Age started smoking this many

EXAMPLE:

This subject began to smoke at 18. Subject usually smokes 45 cigarettes per day since the age of 27.
Prior to this the subject:

Cigarettes smoked per day	Age started smoking this many
40	26
35	25
13	18

WHEN TABLE IS COMPLETED, GO TO 103.

94. Did you ever smoke cigarettes, (even occasionally)? 1. yes 2. no
(If 'no', skip to 103)
95. Did you smoke cigarettes with or without filters? 1. with filters
2. without filters
3. both with and without filters
96. Did you inhale? 1. yes 2. no
97. How old were you when you began to smoke cigarettes? _____ age
98. How old were you when you stopped smoking cigarettes regularly? _____ age
(Specify on smoking history table)
99. What was the usual number of cigarettes you smoked per day just before you stopped? _____ number per day
100. At what age did you start smoking this many? _____ age
101. Please fill in the table until all of your smoking history as per example shown below.

Cigarettes smoked per day	Age started smoking this many

EXAMPLE:

This subject began to smoke at 14. Subject smoked 25 cigarettes per day from age 33 till quitting.

Prior to this the subject:

Cigarettes smoked per day	Age started smoking this many
37	27
25	24
20	21
15	17
7	14

102. Were you influenced to stop because you had a cough, wheezing or shortness of breath? 1. yes 2. no
103. Do you now smoke pipes or cigars, even occasionally? 1. yes 2. no
(If 'no', skip to 107)
104. How many pipefuls or cigars do you usually smoke each day? _____ number per day
105. Do you usually inhale when you smoke either pipes or cigars? 1. yes 2. no
106. How old were you when you first smoked pipes or cigars? _____ age
(Skip to 113)
107. Did you ever smoke pipes or cigars, even occasionally? 1. yes 2. no
(If 'no', skip to 113)
108. How many pipefuls or cigars did you usually smoke each day? _____ number per day
109. Did you usually inhale when you smoked either pipes or cigars? 1. yes 2. no
110. How old were you when you first smoked pipes or cigars? _____ age
111. How old were you when you stopped smoking pipes or cigars? _____ age
112. Were you influenced to stop because you had a cough, wheezing or shortness of breath? 1. yes 2. no
113. After you stopped smoking would you say that your state of health:
1. got worse
2. remained the same
3. got better
4. got much better

If '1', '3', or '4', please specify in what way.

PROCEED TO 114 or 117

NOW SOME QUESTIONS ABOUT YOUR FAMILY, HOME & HOBBIES

(QUESTIONS 114, 115, and 116 FOR CHILDREN ONLY)

114. Do you have any brothers or sisters?

1. yes 2. no

115. How many brothers and sisters?

116. What is your rank in the children?

_____ Oldest is rank 1

117. What is the number of people in your household?

_____ number

118. How many are smokers?

_____ number

119. How many bedrooms are there in your home?

_____ number

120. How many other rooms are there in your home?

_____ number

121. What type of heating system is used in your home?

1. none
2. forced air heating
3. circulating hot water or steam
4. electric radiant heating
5. wood stoves
6. coal stoves
7. other

(We do not mean the fuel used for heating)

If 'other' please specify.

122. In addition to the above, do you use a fireplace in your home?

1. yes 2. no

123. What fuel is used for cooking?

1. electricity
2. gas
3. wood
4. coal

124. Do you use a humidifier in the winter?

1. yes 2. no

125. Do you or does any member of your household keep animals or pets?

1. yes 2. no

("If 'yes' please specify.")

126. Have you any hobby which exposes you to dusts, gases or fumes, such as from paints, glues or wood dust?

1. yes 2. no

("If 'yes' please specify.")

127. Do you play any sport regularly?

1. yes 2. no

("If 'yes' please specify.")

128. Do you ride a bicycle regularly?

1. yes 2. no

129. What distance do you walk daily (ex. going to school, to work, etc.)

1. $\frac{1}{2}$ mile or less
2. $\frac{1}{2}$ to 1 mile
3. 1 to 2 miles
4. more than 2 miles

130. Do you think you are more exercise minded than most other people of your age?

1. yes
2. no

131. How many hours a day do you watch TV?

_____ hours

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132. Ear data

133. Nose data

134. Throat data

135. Blood pressure (adults)

HEALTH EFFECTS DIVISION
ENVIRONMENTAL HEALTH DIRECTORATE

(REV I)

January, 1976

CA 1 HW 11 77 R27
Canada. Dept. of Health & Welfare.
Report on Sydney Rep.
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